PowerTronics

Model PQR1010

Power Quality Recorder

User's Manual

All information and specifications written or implied in this manual are current at the time of printing. However due to ongoing process of adding improvements to the products, PowerTronics / Eastern Time Designs, Inc. reserves the right to make changes at any time without notice.

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SAFETY NOTICE

The power cable attached to the device is supplied with a safety and reference ground. Do not use the PQR 1010 when powered from an ungrounded outlet.

High voltage exists at many points inside the cabinet. Qualified personnel ONLY! should open the covers. Opening the covers may affect the warranty.

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INTRODUCTION

This reference guide is designed to aid PQR1010 users in the interpretation of AC power line problems.

This unit will detect a wide range of power disturbances including spikes, sags, surges, common mode noise, dropouts, and high frequency noise on 2 phases of voltage and 1 DC Channel, as well as test the Temperature, Humidity, and Current.

The PQR1010 is one of a series of practical power line monitors, designed and priced to be outfitted to everyone who services or installs three phase electrical, and electronic equipment.

Electronic equipment is damaged more often by power disturbances than by fire, theft, and vandalism combined. Intermittent power problems are the most expensive hidden expense to the owners of microprocessor based equipment.

The PQR1010 is easy to use and provides immediate and long term information for the technician and customer to understand power line disturbances.

To monitor the AC and DC circuits with the PQR1010, connect the test leads between the circuits to be tested, and the connectors located on the back of the unit. Plug the line cord provided into a standard 110 volt or 220 volt outlet. After running an internal self test, the unit will start testing.

Included with the PQR1010

Each PQR1010 is supplied with a 6 foot power cord, RS232 communications cable with DB9F termination, Windows 98/NT/XP data analysis software, temperature probe, one set of AC voltage test leads and one set of DC voltage test leads. Humidity probe must be ordered separately, model no. PQR-HUMIDITY

CALIBRATION

The PQR1010 monitors are designed to test the Power Line with a high degree of accuracy. In this unit all measurements are referenced to a state of the art, temperature compensated voltage source. It is recommended that each unit be calibrated annually by the factory as certain components may require calibration. Contact OMEGA for details on returning your unit for calibration.

Power and Environmental Quality Monitor

- User - Friendly
- Multi Channel - AC Voltage, DC Voltage, Current, Humidity and Temperature
- Disturbance Recorder and Voltage Logger
- Easy to Understand Reports
- Simple connection to a Computer or Terminal
- Made in USA

The PQR1010 Power Quality Recorder is a state of the art, fully integrated instrument which measures, records, and reports power disturbances, aiding in the analysis of power quality in medical, commercial and industrial applications.

Disturbances detected on multiple channels are recorded by their time, date, magnitude, and duration in a non-volatile RAM memory. This data is then retrieved from the analyzer through its' serial communications port.

Connections to the PQR1010 are made between the safety connectors on the back of the unit, and the circuit panel to be tested. The power to operate the unit comes from any standard 110v / 220v AC outlet. Once plugged in, the PQR1010 immediately begins testing the signals on the input connectors.

PQR1010 Power Quality Recorder

Monitor 2 AC Channels,

DC, Temperature and Humidity and Current
(with optional probes)

- User - Friendly
- Programmable
- Multiple Phase Monitoring
- Fast Impulse Detection
- Easy to Understand Reports
- Made in USA

The PQR1010 Power Line Analyzer provides a complete analysis of your AC Power for a fraction of the cost of other Monitors**.**

Disturbances detected on the Hot and Neutral Lines , as well as Temperature and Humidity channels are recorded by their time, date, magnitude, and duration in a non-volatile RAM memory. This data is then retrieved from the analyzer through it's serial communications port.

The power to operate the unit comes from any standard 110v / 220v AC outlet. Once plugged in, the PQR1010 immediately begins testing the signals on the input connectors.

Features

- Measures all types of disturbances

  * Spikes
  * Sags
  * Line Frequency
  * Dropouts
  * Surges
  * Humidity
  * AC Voltage
  * Common Mode Noise
  * High Frequency Noise
  * Power Failures
  * Temperature

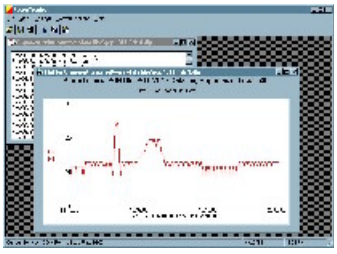
- Simple to operate

  1) Plug the power cord into a grounded outlet
  2) Periodically connect to a computer for reports

- Stores Disturbance events in non-volatile RAM
  * 32,000 Events in all
  * Will Data log all channels up to 32,000 readings
    (22.75 Days @ 1 sample per minute)

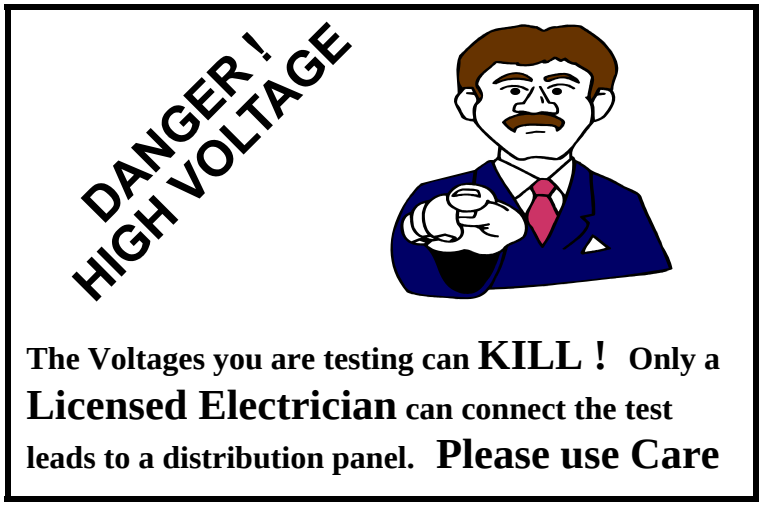
GRAPHICS SOFTWARE INCLUDED!

Provided with the **PQR1010** is the **PQR HOST COMMUNICATIONS** Software. This software allows you to easily download the data and display or print the **DATALOG** chart over time, the **PIE CHART** of the summary of events or the **HISTOGRAM** of the detail of events.



In addition to full Text Detail and Summary reports, event information such as the Magnitude, Time, and Date of each of the disturbances is also reported.

Apply the Test Signals:



The Voltages you are testing can KILL ! Only a Licensed Electrician can connect the test leads to a distribution panel. Please use Care

All signals to be tested are applied to the TEST input jacks located on the back of the PQR1010.

Apply AC voltage to the AC inputs at AC-1 and AC-2,
Apply the DC inputs to Port marked DC-1,
Plug the Optional Current Probe into jacks marked CURRENT,
Plug the temp probe into the port marked AUXILIARY,
Plug the Optional Humidity probe into the port marked HUMIDITY.

Note:
All signals are referenced to the safety ground of the unit. For both Safety reasons, and for the unit to measure signals properly, **The unit MUST have a safety ground.** (Plugging the PQR1010 into a grounded outlet will take care of this)

Testing AC Voltage with the PQR1010

The PQR1010 has two channels of AC Voltage power line analyzing which are designed to obtain the maximum amount of useful data from the circuit under test, while requiring the minimum amount of setup time.

Data from the two AC input connectors starts being collected as soon as power is applied to the AC power connector located on the back of the unit. Data will continue to be gathered until the unit is powered down.

Long term voltage recording is known as Data Logging. The PQR1010 samples the voltage on each of the AC inputs continuously , and stores the average reading once each minute (or at other selected intervals). There is enough data storage capacity in the unit to collect these readings on both channels for 11 days.

The PQR1010 will continuously test the two phases of voltage for Sags, Surges, Power Failures, Dropouts, Impulses, High Frequency Noise, Line Frequency, and Phase changes. Any power quality problems that exceed the preset thresholds will be recorded in battery backed RAM, with the time and date stamp of the event. There is enough data storage capacity in the unit to collect up to 1500 of these readings on both channels.

PQR1010 Side Panel

Testing DC Voltage with the PQR1010

The PQR1010 has one channels for analyzing DC Voltage. This channel has a maximum input of +/-50V for testing low voltage supplies.

Data from the DC input connector starts being collected as soon as power is applied to the AC power connector located on the back of the unit. Data will continue to be gathered until the unit is powered down.

The PQR1010 samples the voltage on the DC input continuously, and stores the average reading once each minute (or at other selected intervals). There is enough data storage capacity in the unit to collect these readings on this channel for 11 days.

The PQR1010 will continuously test the DC input for Sags, Surges, Power Failures, Dropouts, Impulses, and High Frequency Noise. Any power quality problems that exceed the preset thresholds will be recorded in battery backed RAM, with the time and date stamp of the event. There is enough data storage capacity in the unit to collect up to 1500 of these readings.

OM-PQR1010 Back Panel

Testing Temperature with the PQR1010

The PQR1010 is equipped with a temperature input port. The included Temperature probe may be plugged into this port to provide Data logging and fault detection of the ambient temperature.

Data from the Temperature input port starts being collected as soon as power is applied to the AC power connector located on the back of the unit. Data will continue to be gathered until the unit is powered down.

The PQR1010 samples the temperature port continuously, and stores the average reading once each minute (Data Logging) (or at other selected intervals). There is enough data storage capacity in the unit to collect these readings for 11 days.

The PQR1010 will continuously test the Temperature input for Sags, and Surges. Any deviations that exceed the preset thresholds will be recorded in battery backed RAM, with the time and date stamp of the event. There is enough data storage capacity in the unit to collect up to 1500 of these readings.

OM-PQR1010 Back Panel

Testing Humidity with the PQR1010

The PQR1010 is equipped with a Humidity input port. The optional Humidity probe may be plugged into this port to provide Data logging and fault detection of the ambient Humidity.

Data from the Humidity input port starts being collected as soon as power is applied to the AC power connector located on the back of the unit. Data will continue to be gathered until the unit is powered down.

The PQR1010 samples the Humidity port continuously, and stores the average reading once each minute (Data Logging) (or at other selected intervals). There is enough data storage capacity in the unit to collect these readings for 11 days.

The PQR1010 will continuously test the Humidity input for Sags, and Surges. Any deviations that exceed the preset thresholds will be recorded in battery backed RAM, with the time and date stamp of the event. There is enough data storage capacity in the unit to collect up to 1500 of these readings.

OM-PQR1010 Back Panel

Testing Current with the PQR1010

The PQR1010 is equipped with a pair of banana jacks designed to accept a Current Transducer (CT) The output of the CT will provide the signal necessary for the PQR1010 to record data about the quality of the line being tested.

Data from the CT starts being collected as soon as power is applied to the AC power connector located on the back of the unit. Data will continue to be gathered until the unit is powered down.

The PQR1010 samples the Current channel continuously, and stores the average reading once each minute (or at other selected intervals). There is enough data storage capacity in the unit to collect these readings for 11 days.

The PQR1010 will continuously test the Current Channel for Sags, and Surges. Any deviations that exceed the preset thresholds will be recorded in battery backed RAM, with the time and date stamp of the event. There is enough data storage capacity in the unit to collect up to 1500 of these readings.

OM-PQR1010 Side Panel

Power Up Sequence

Apply AC or DC Power:

There is a Unit Status LED on the back of the PQR1010. This led is used to indicate system diagnostics status, and Channel operational status.

When the PQR1010 is first connected to AC or DC power (110VAC or 220 VAC, or 12/24V DC), it will go through a series of power on diagnostics. The status of these tests can be seen in the Channel Status LED located on the back panel. While the initial tests are being executed, (approximately 10 seconds long) the Red LED will be blinking. After the tests are completed, the LED will turn off briefly, and then turn on steady.

The LED will blink for ten seconds, whenever there is a disturbance detected on any input, or the serial port has been accessed.

As soon as the diagnostics have completed, the PQR1010 is on-line, and monitoring the input channels. The unit should be left on-line testing for at least a 72 hour period.

OM-PQR1010 Side Panel

Connecting to the PQR1010

DIRECT:

The serial port connector on the back of the PQR1010 is a 9 pin DB style RS232. the pinout is a s follows:

Pin 2	Receive Data
Pin 3	Transmit Data
Pin 5	Ground

To establish a connection with this port and a PC, a Null modem cable must be used. This type of cable connects the Transmit Data pin on the PC to the Receive Data pin on the PQR1010, and the Transmit Data pin on the PQR1010 to the Receive Data pin on the PC. It also connects the Ground pins together.

The PQR1010 is configured to operate at 19,200 baud, with 8 data bits, 1 stop bit, and no parity checking.

MODEM:

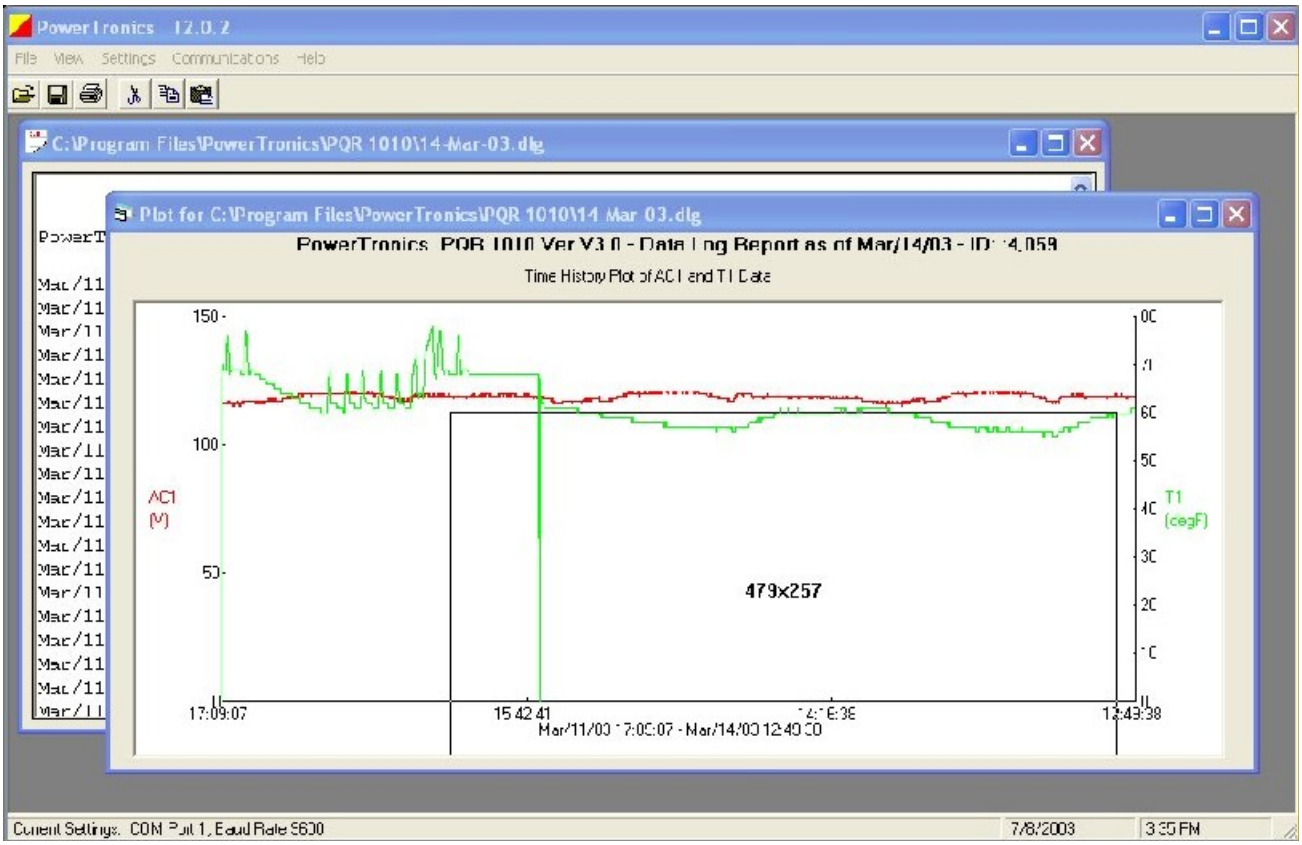
Use a straight cable (not a null modem) when connecting to a modem.

Power the PQR1010 and the Modem up at the same time after connecting the cable, and the PQR1010 will auto config the Hayse compatible Modem for auto answer mode, at 19,200 baud. If the modem is not Hayse compatible, configure it to answer the phone on 2 rings, with a Baud rate of 19,200, 8 data bits, 1 stop bit, and no parity checking.

PQR Host Communications Software:

The PQR1010 is provided with the Powertronics Host Communications Software. When the PQR1010 is connected to a computer with a null modem cable, the Host software provides several functions:

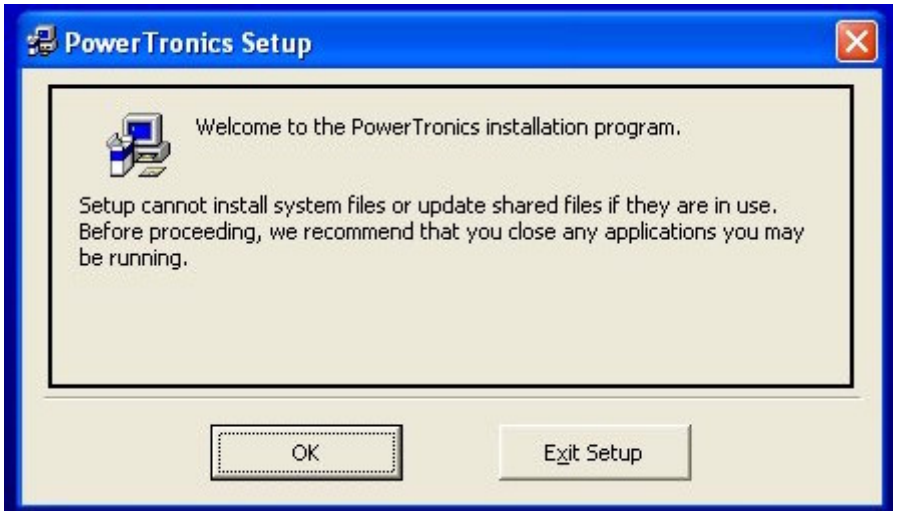
- Automatically connect to the PQR1010
- Configure the PQR1010's settings
- Download data from the PQR1010 and Save on the computer
- Generate Reports, Charts and Graphs from the downloaded data



Installing the PQR Host Communications Software

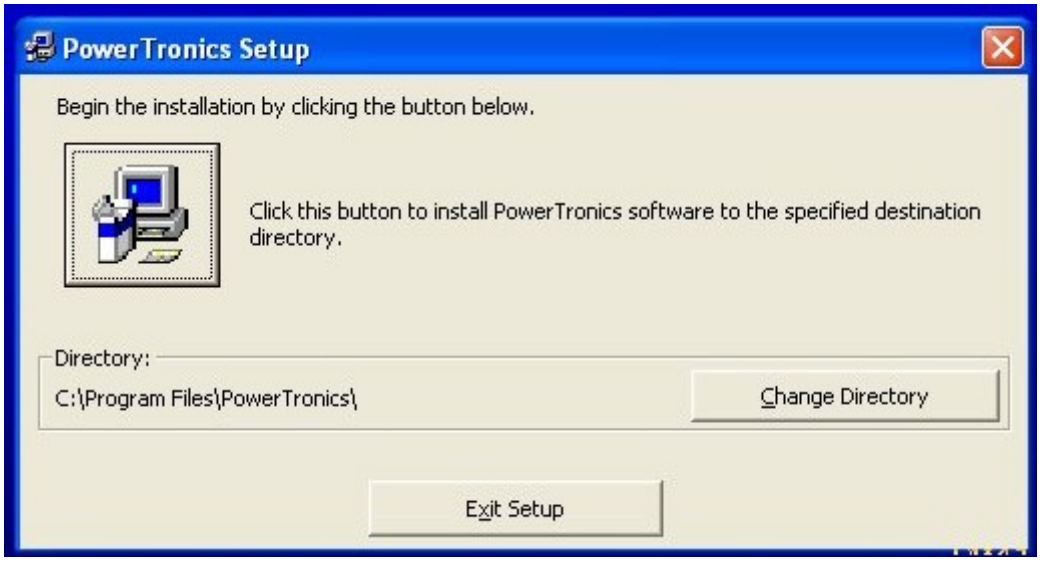
- Put Disk 1 provided with your unit into your disk drive.

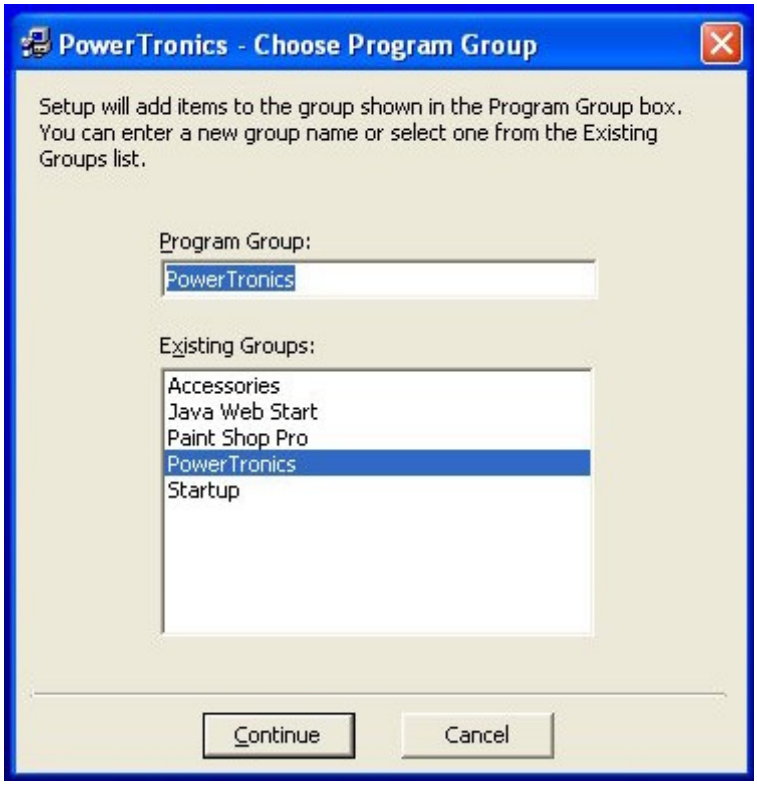
Select or Double click on **SETUP**
A series of files will be copied to your computer's RAM


PowerTronics Setup
Welcome to the PowerTronics installation program.
Setup cannot install system files or update shared files if they are in use. Before proceeding, we recommend that you close any applications you may be running.
OK
Exit Setup

To prevent any software conflicts, you should close any other applications programs running before continuing with the PQR Host software installation, then click on **OK**.

Click on the Computer Button to start the installation.

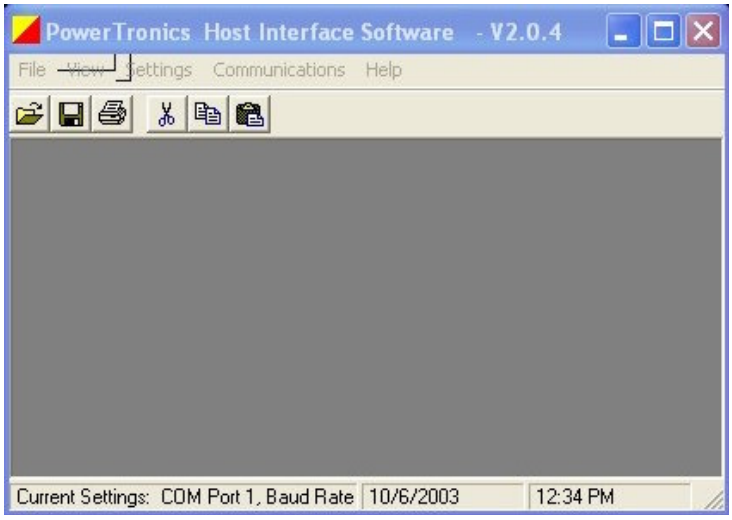

PowerTronics Setup
Begin the installation by clicking the button below.
Click this button to install PowerTronics software to the specified destination directory.
Directory:
C:\Program Files\PowerTronics\
Change Directory
Exit Setup



Clicking on **CONTINUE** will allow the installation to complete.

The PQR Host communications software can now be started.

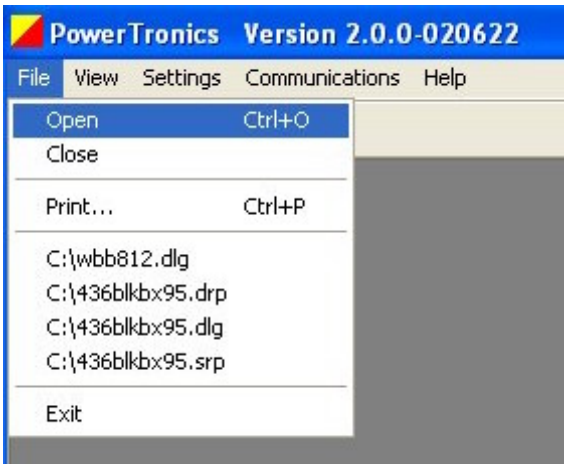
- Click on **START**
- Select **PROGRAMS**
- Select **POWERTRONICS**


PowerTronics Host Interface Software - V2.0.4
File View Settings Communications Help
Current Settings: COM Port 1, Baud Rate
10/6/2003
12:34 PM

This Screen is the starting point for working with the PQR D52.

File Menu

The "File" menu contains options for using data files that are stored on disk.



Open

Select the "Open" menu item to open a data log, detail report, or summary report that is stored on disk. After specifying the desired file, the program will open a window that contains the data from the file.

Close

Select the "Close" menu item to close the active window.

Print
Select the "Print" option to send the active window to a printer. This menu item will display a Print Dialog for the user to select which printer to use and to specify the desired settings.

Memory Files
The program will keep track of the last four files that have been used, and keep their names and locations in memory. To reopen any of these files, simply select the menu item with the desired file's name. The program will display the contents of the file in a new window.

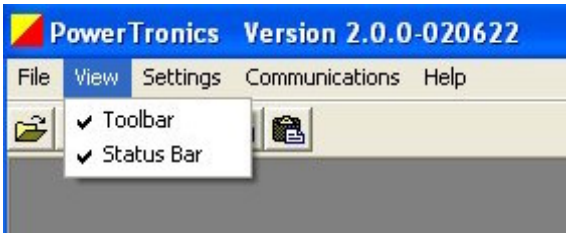
Exit
Select the "Exit" menu item to close all windows and exit the program.

Other options that are sometimes shown:

Save
Select the "Save" menu item to save the active data file to its current file name and location.

Save As...
Select the "Save As..." menu item to save the active data file to a new file name and location.

View Menu



The "View" menu contains items used to control what tools are visible and available to the user in the main program window.

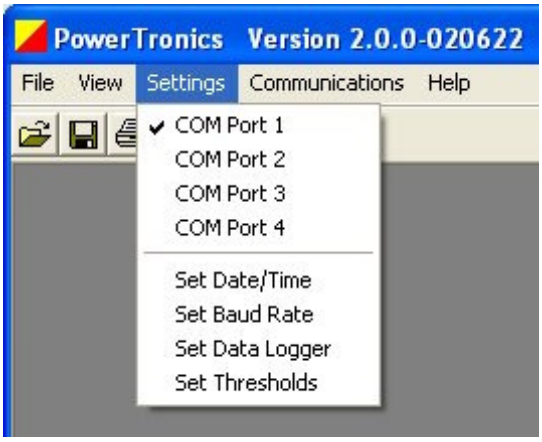
Toolbar

Select the "Toolbar" menu item to toggle the toolbar. The toolbar contains the buttons for opening and printing files.

Status Bar

Select the "Status Bar" menu item to toggle the status bar at the bottom of the main program window. The status bar displays the program's current COM port and baud rate settings.

Settings Menu



The "Settings" menu contains items that allow the user to specify certain settings for communication between the software and the PQR device. The menu also provides an interface for setting the PQR device parameters.

COM Port 1 - COM Port 4

The "COM Port" menu items are used to specify which computer COM port the PQR device is connected to. Selecting one of the options will change the program setting to that particular port. The current settings are indicated by a check mark next in the Settings menu. The current COM port setting is also displayed in the status bar at the bottom of the main program window.

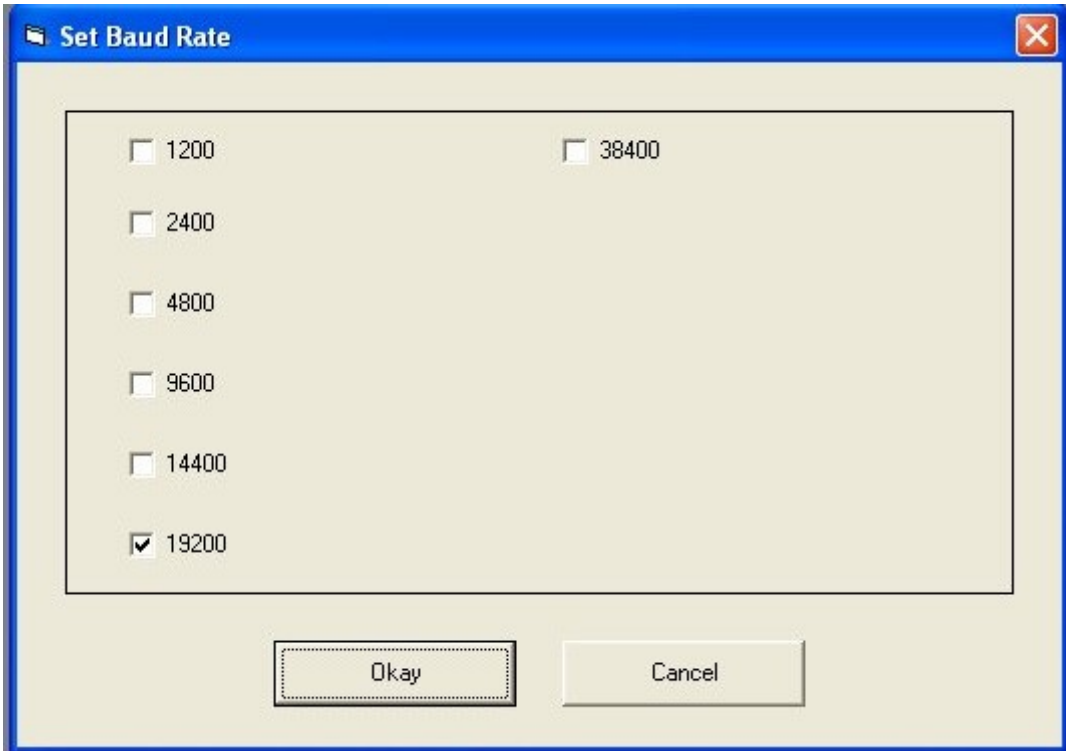
Set Date/Time

Select the "Set Date/Time" menu item to set the device date and time.

A dialog box will be displayed that provides the user an interface with which to specify the date and time. The settings will be defaulted to the current date and time, or to the date and time specified previously in the same program session.

After inputting the desired date and time, pressing the "Okay" button will instruct the program to set the device to the specified settings. This process may take a few seconds.

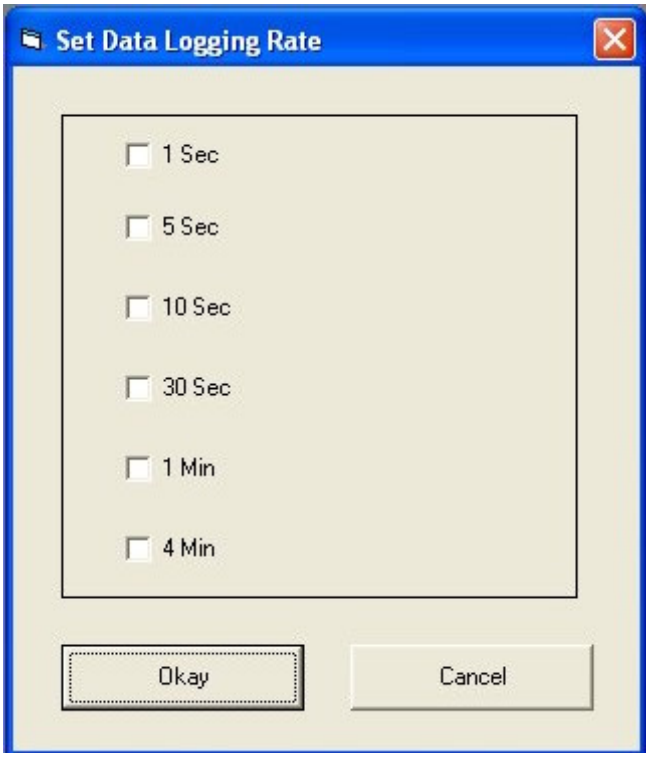
Set Baud Rate



The "Set Baud Rate" menu option allows the user to specify the data rate to be used when communicating with the device. The program will display a dialog box with the six valid baud rates to select from: 2400, 4800, 9600, 14400, 19200 and 38400. After selecting the desired baud rate, pressing the "Okay" button will instruct the program to set the device baud rate. This process may take a few seconds. The program baud rate setting will also be set to the selected setting.

When the rate is changed, the new setting is saved in FLASH RAM, and is used as the power up default until the next time the setting is changed.

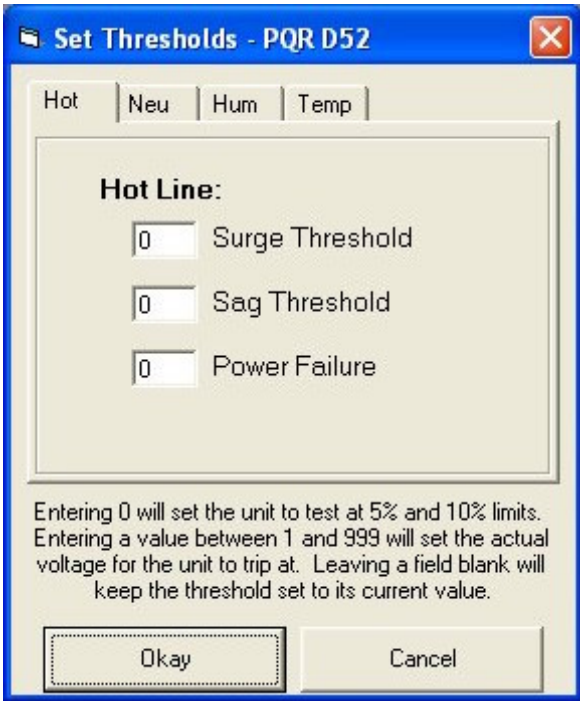
Set Data Logger



The "Set Data Logger" menu item allows the user to specify the device data logging rate, or the time in between data log samples. The user will be provided six choices: 1 second, 5 seconds, 10 seconds, 30 seconds, 1 minute, or 4 minutes. After selecting the desired logging interval, pressing the "Okay" button will instruct the program to set the device setting. This process may take a few seconds.

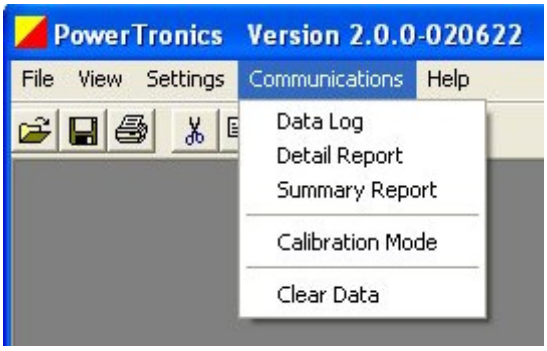
When the rate is changed, the setting is NOT saved in non-volatile RAM. The power up default is one sample per minute.

Set Thresholds


Set Thresholds - PQR D52
Hot
Neu
Hum
Temp
Hot Line:
0
Surge Threshold
0
Sag Threshold
0
Power Failure
Entering 0 will set the unit to test at 5% and 10% limits. Entering a value between 1 and 999 will set the actual voltage for the unit to trip at. Leaving a field blank will keep the threshold set to its current value.
Okay
Cancel

The "Set Thresholds" menu item allows the user to specify the thresholds at which the device will trigger events. The user will be provided a dialog box with input fields to specify the surge, sag, and power failure thresholds for all available lines. Entering zero will set the unit to test at 5% and 10% limits. Entering a value between 1 and 999 will set the actual voltage for the unit to trip at. Leaving a field blank will keep the threshold set to its current value. After specifying the desired settings, pressing the "Okay" button will instruct the program to set the device settings. This process may take a few seconds

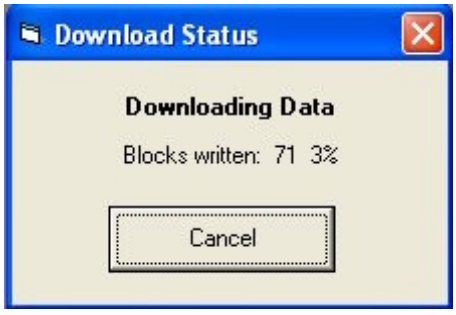
Communications Menu



The "Communications" menu contains items that allow the user to retrieve data from the PQR device.

When you click on any of these functions, the PQR Host Communications software will automatically scan your serial ports looking for the connected PQR D52. The software will attempt to match the communications settings to the PQR D52, and will then perform the selected function.

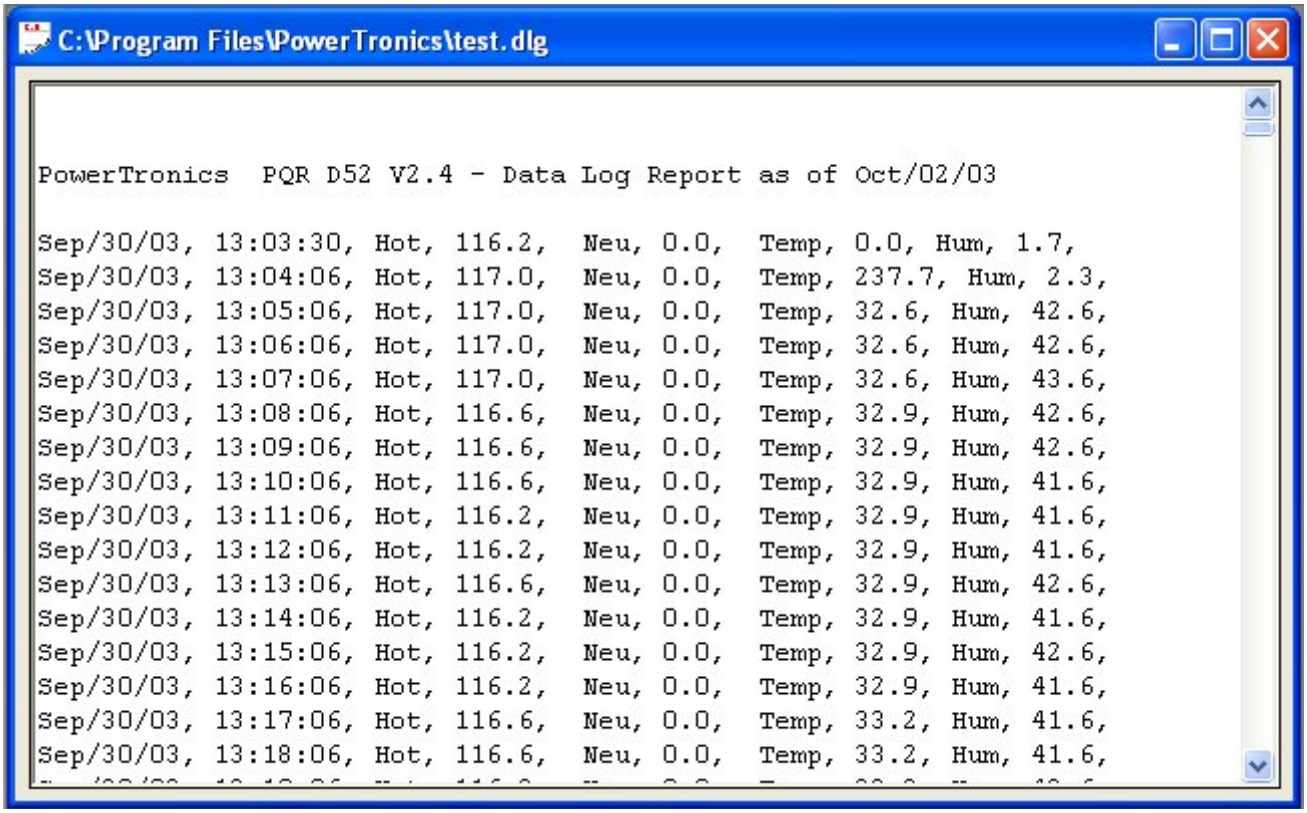
For example, when you click on the Data Log report, the software will locate the PQR D52, and start downloading the data. The status of the download is reported as:



The blocks will count up until all of the data is downloaded and saved in the data file.

Data Log

Selecting the "Data Log" menu item will download a listing of the voltages measured on all of the input channels since the unit was put on-line and the RAM was cleared. Before starting the transmission, the user will be asked to specify the name and location of a file to write the data to. After the transfer is complete, the program will automatically open a data window containing the downloaded data.

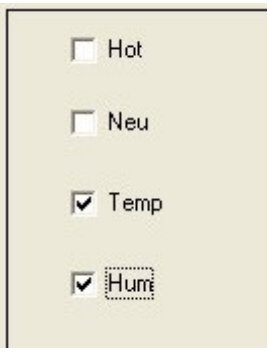


This is the text report showing the Date and Time of the reading, the voltage on each of the Hot and Neutral Lines as well as the readings from the Temperature and Humidity sensors.

Notice that the Graph option now shows up on your toolbar. Since you now have data available, you can generate the charts and graphs that represent that data.

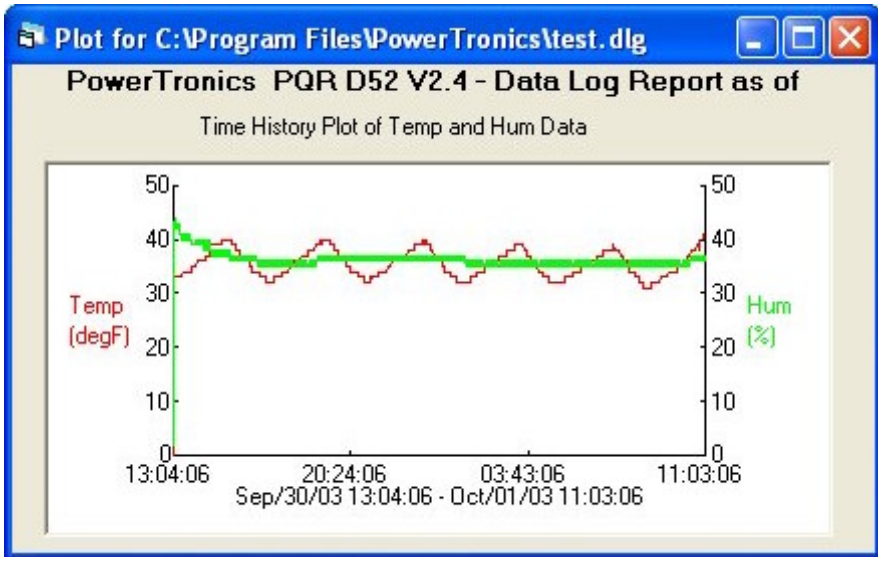
Data Log Graph

Select the **Plot Time History** selection under **Graph**

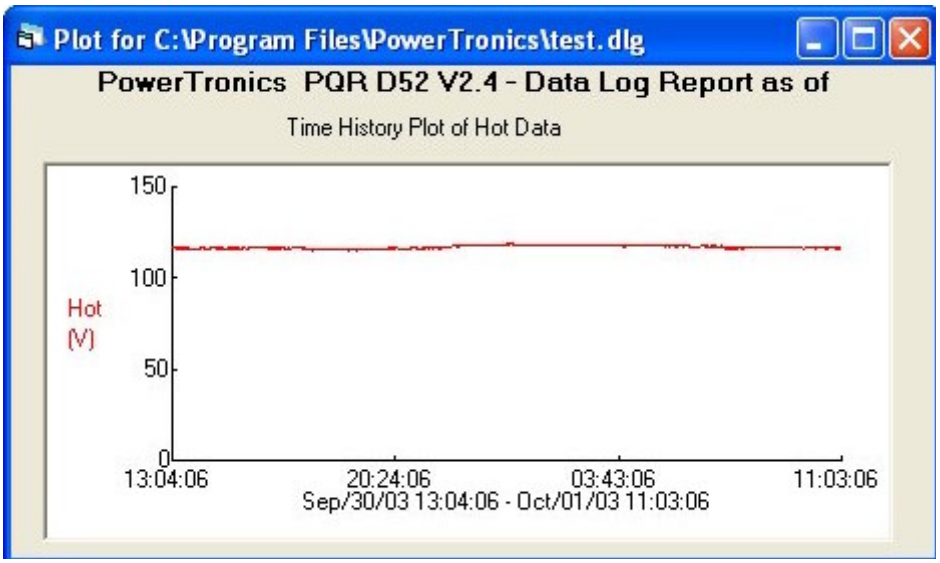


Select 1 or 2 of the available channels to graph

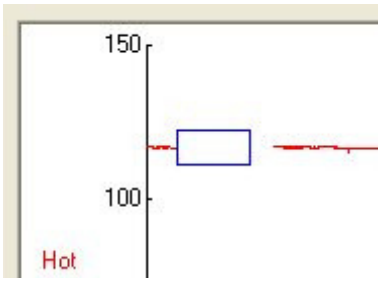
Once the channels are selected, and the **Okay** button is clicked, the software will scan the data file and generate a chart showing the data in chart form.



Data Log chart of Temperature and Humidity



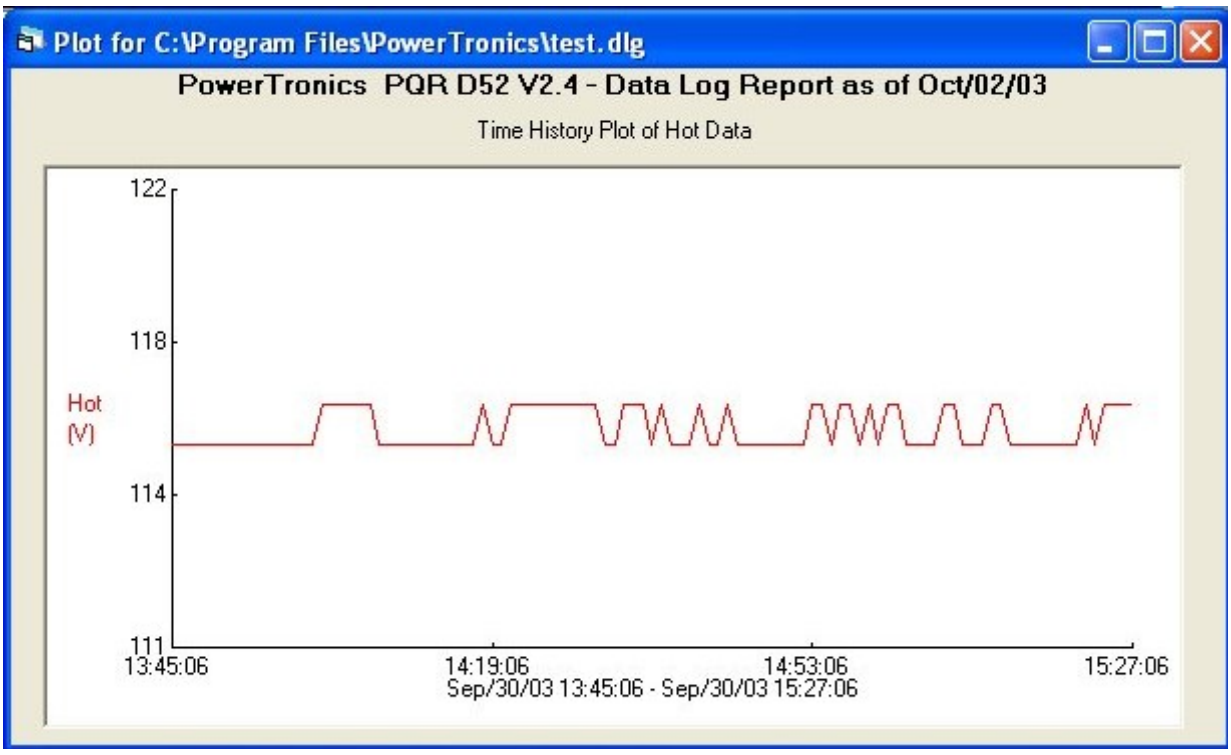
This is the chart generated from a days worth of data logging on a 120V AC Line.



the

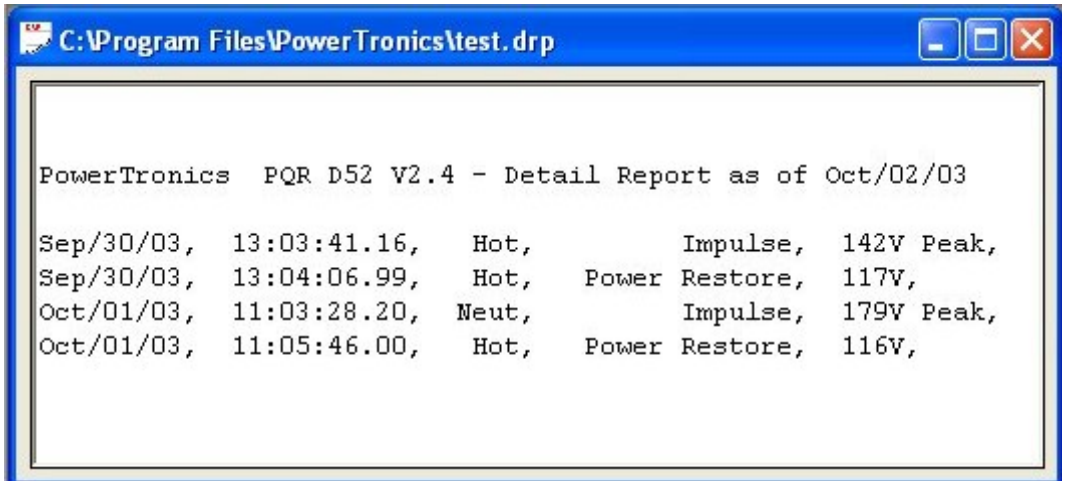
By holding down your Left Mouse Button you create a selection box. You can drag your mouse, and create a ZOOM Area around your data. When you release the mouse button, data in the ZOOM area is expanded to fill the screen area.

Double clicking on the chart will return it to original size.



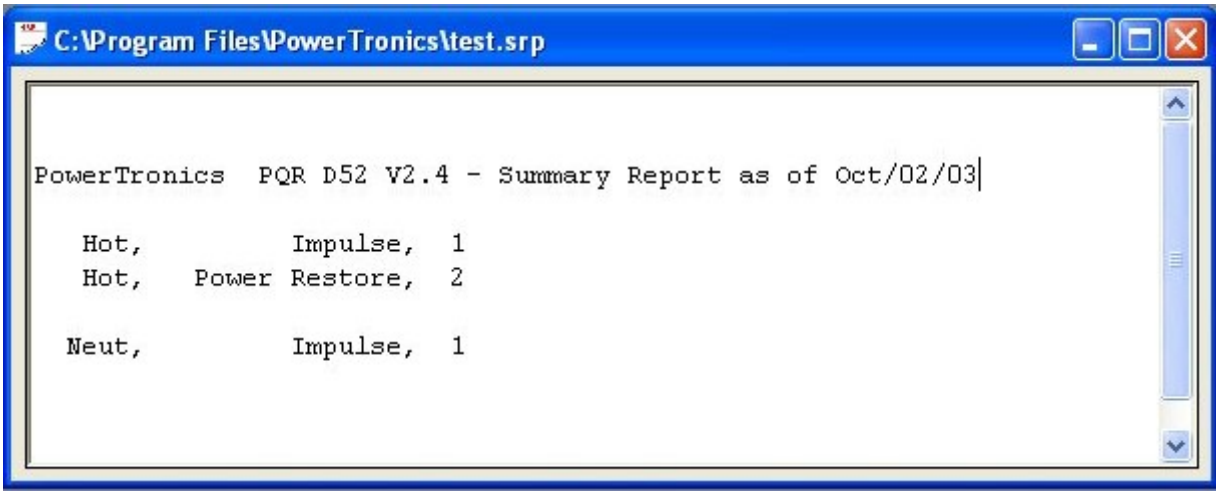
Detail Report

Selecting the "Detail Report" menu item will download a listing of all the disturbances saved since the unit was put on-line and the RAM was cleared. Before starting the transmission, the user will be asked to specify the name and location of a file to write the data to. After the transfer is complete, the program will automatically open a data window containing the downloaded data. Each event is described by the date, time, phase, event type, and magnitude of that disturbance..


C:\Program Files\PowerTronics\test.drp
PowerTronics PQR D52 V2.4 - Detail Report as of Oct/02/03
Sep/30/03, 13:03:41.16, Hot, Impulse, 142V Peak,
Sep/30/03, 13:04:06.99, Hot, Power Restore, 117V,
Oct/01/03, 11:03:28.20, Neut, Impulse, 179V Peak,
Oct/01/03, 11:05:46.00, Hot, Power Restore, 116V,

Summary Report

Selecting the "Summary Report" menu item will download a listing of counts of all the disturbances detected since the unit was put on-line and the RAM was cleared. Before starting the transmission, the user will be asked to specify the name and location of a file to write the data to. After the transfer is complete, the program will automatically open a data window containing the downloaded data. Each event is described by the phase, event type, magnitude, and quantity of that disturbance.


C:\Program Files\PowerTronics\test.srp
PowerTronics PQR D52 V2.4 - Summary Report as of Oct/02/03
Hot, Impulse, 1
Hot, Power Restore, 2
Neut, Impulse, 1

Selecting the Chart options from this report allows you to generate a pie chart showing the distribution of the detected events.

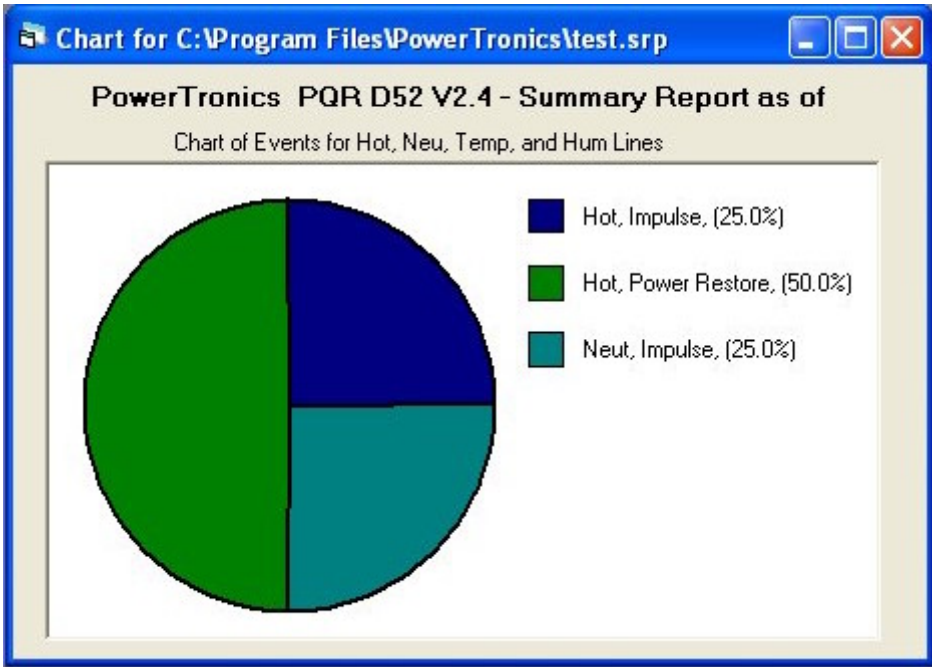
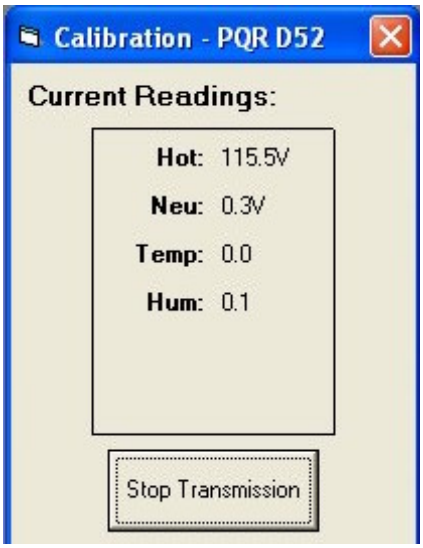


Chart for C:\Program Files\PowerTronics\test.srp
PowerTronics PQR D52 V2.4 - Summary Report as of
Chart of Events for Hot, Neu, Temp, and Hum Lines
Hot, Impulse, (25.0%)
Hot, Power Restore, (50.0%)
Neut, Impulse, (25.0%)

Calibration Mode



Selecting the "Calibration Mode" menu item will command the device to begin transmitting the current voltage readings to the computer. The voltage readings are then displayed in a special window. The voltage readings will be updated approximately once a second. No other command can be performed while the program is in calibration mode. To end the transmission, user must press the "Stop Transmission" button; otherwise, the transmission will automatically stop after about two minutes.

Clear Data

Selecting the "Clear Data" menu item will clear all of the events and data log information stored in the internal battery backed RAM in the device. The summary report quantities will be reset to zero, and the data logging will start tracking voltage again. The program will ask the user for confirmation before transmitting the "Clear" command to the device.

Note: A large amount of time may be necessary in the cases where data is transmitted from the device to the computer. The exact duration is dependent upon the baud rate setting and the amount of data being downloaded. In these cases ("Data Log", "Detail Report", and "Summary Report"), a status window is displayed allowing the user to modify the progress of the transmission. The status window shows a running count of blocks written to disk during the current transmission. The block count provides an approximate measure of the amount of data that has been transferred, and the actual size of a block depends on the baud rate setting. The user can cut a transmission short by simply pressing the "Cancel" button.

Other Communications

In the event that you would like to communicate with the PQR 1010 without using the PQR Host Communications software, you can connect using most other terminal emulator software.

Commands:

The PQR 1010 will respond to commands received through the serial port. All commands are started with a C. Entering C, followed by the command number will initiate the function.

The commands are as follows:

C0	Transmit the Command Menu
C1	Transmit the Unit Version number
C2	Transmit a Summary Report
C3	Transmit a Detail Report
C4	Transmit a Data Log of recorded voltage
C5	Clear all events, and data log
C6	Set the Date and Time
C90	Continuous transmission of channels readings
CX	Hang up the phone .

After the PQR 1010 has completed the task initiated by the operator command, it returns on-line to it's monitoring duties. Each of the commands are detailed in the following pages.

C0 - Transmit the Command Menu:

This command will transmit the Command Menu back to the operator through the serial port. This is usually the first command to be issued when the operator is connected to the PQR1010.

Transmit or type: **C0, or CONNECT**

The PQR1010 will respond after after several seconds with:

This Menu can be called up any time the operator is connected to the unit,

PQR1010 V2.1 Aug. 01,00 11:05:32.53 - ID: 33271

These are your Command Options:

C 0 -	**Display this Command List**
C 1 -	**Display Unit Version Number**
C 2 -	**Summary of all Detected Events**
C 3 -	**Detail Report of Stored Events**
C 4 -	**Data Log Report of all Channels**
ESC -	**Will STOP data transfer**
SPACE	**Will Pause data transfers**
C 5 -	**Clear All Events**
C 6 -	**Configure the PQR Hardware**
C X -	**Hang up**

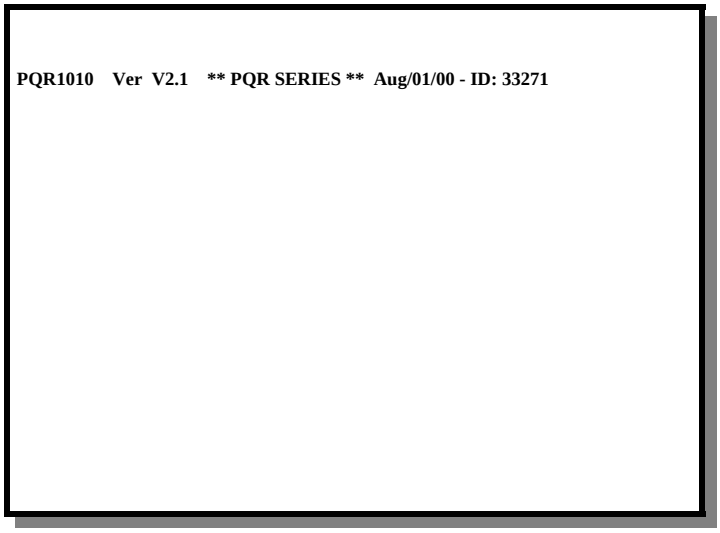
and the Menu is transmitted automatically upon receipt of the word CONNECT from a modem.

C1 - Transmit the Version Number:

This command will transmit the Model Name and Version Number back to the operator through the serial port.

Transmit or type: **C1**

The PQR1010 will respond with:



The Version Number refers to the Firmware Program stored in the PROM located inside the unit. This number is needed whenever the operator contacts OMEGA technical support specialists.

C2 - Transmit a Summary Report:

Transmit or type: **C2**

The PQR1010 will respond by transmitting a report that is a count of all the disturbances detected since the unit was put on-line, and the RAM was cleared:

```
PQR1010   Ver  V2.1  - Summary Report as of Aug/01/00 - ID: 33271

AC Ch 1,  Impulse - 120V      4
AC Ch 1   Impulse - 60V       1
AC Ch 1   Impulse - 20V       7
AC Ch 1   5 Percent Sag       2

AC Ch 2   Impulse - 120V      4
AC Ch 2   Impulse - 60V       2
AC Ch 2   Impulse - 20V       4
AC Ch 2   5 Percent Sag       2

DC Ch 1   Impulse - 500V      1
DC Ch 1   Impulse - 60V       6
DC Ch 1   Impulse - 20V       2
DC Ch 1   5 Percent Sag       2
```

Each event type is described by the Channel Number, Event Type, Magnitude, and Quantity of that disturbance.

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report.

C3 - Transmit a Detail Report:

Transmit or type: **C3**

The PQR1010 will respond by transmitting the Detail Report of all disturbances saved since the unit was put on-line, and the RAM was cleared:

```
PQR1010   Ver  V2.1  - Detail Report as of Aug/01/00 - ID: 33271

Aug,29,00,  07:31:29.53,  AC Ch 1,      Impulse,  20,V Peak,
Aug,29,00,  07:32:05.02,  AC Ch 2,      Impulse,  20,V Peak,
Aug,29,00,  07:32:05.02,  DC Ch 1,      Impulse,  20,V Peak,
Aug,29,00,  07:43:30.85,  AC Ch 2,      Impulse,  120,V Peak,
Aug,29,00,  07:59:43.32,  DC Ch 1,      Impulse,  60,V Peak,
Aug,29,00,  08:01:26.22,  AC Ch 1,      Impulse,  120,V Peak,
Aug,29,00,  08:09:44.72,  DC Ch 1,      Impulse,  600,V Peak,
Aug,29,00,  08:11:26.92,  DC Ch 2,      Impulse,  20,V Peak,
Aug,29,00,  09:15:22.57,  DC Ch 1,      Impulse,  20,V Peak,
Aug,29,00,  09:18:33.23,  AC Ch 2,      Impulse,  60,V Peak,
Aug,29,00,  09:32:19.56,  AC Ch 1,      Impulse,  120,V Peak,
Aug,29,00,  09:32:19.56,  DC Ch 2,      Impulse,  20,V Peak,
Aug,29,00,  09:43:27.33,  AC Ch 1,      Impulse,  60,V Peak,
Aug,29,00,  10:01:29.74,  AC Ch 1,        Sag,  5,Percent,
Aug,29,00,  10:01:29.74,  AC Ch 2,        Sag,  5,Percent,
Aug,29,00,  10:01:29.74,  DC Ch 1,        Sag,  5,Percent,
Aug,29,00,  10:10:52.32,  AC Ch 1,      Impulse,  120,V Peak,
Aug,29,00,  10:10:52.32,  AC Ch 2,      Impulse,  120,V Peak,
Aug,29,00,  10:10:52.32,  DC Ch 1,      Impulse,  60,V Peak,
Aug,29,00,  10:10:52.32,  DC Ch 2,      Impulse,  20,V Peak,
Aug,29,00,  11:35:22.47,  DC Ch 1,      Impulse,  60,V Peak,
```

Each event is described by the Time, Date, Channel Number, Event Type, and Magnitude of that disturbance.

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report.

Typing the Space bar will Pause or re-start the report.

C4 - Transmit a Data Log Report:

Transmit or type: **C4**

The PQR1010 will respond by transmitting the Listing of the voltages measured on all input channels each minute (or at other programmed time) since the unit was put on-line, and the RAM was cleared:

```
PQR1010   Ver  V2.1  - Data Log Report as of Sep/01/00 - ID: 33271

Aug/29/00, 12:13:00, AC1,  119,  AC2,  118,  Temp,  68, HUM,  54,  DC,  30, Cur,  9A
Aug/29/00, 12:14:00, AC1,  119,  AC2,  118,  Temp,  68, HUM,  54,  DC,  30, Cur,  9A
Aug/29/00, 12:15:00, AC1,  118,  AC2,  118,  Temp,  68, HUM,  54,  DC,  30, Cur,  10A
Aug/29/00, 12:16:00, AC1,  118,  AC2,  118,  Temp,  68, HUM,  54,  DC,  32, Cur,  10A
Aug/29/00, 12:17:00, AC1,  118,  AC2,  118,  Temp,  68, HUM,  54,  DC,  32, Cur,  11A
Aug/29/00, 12:18:00, AC1,  117,  AC2,  118,  Temp,  69, HUM,  54,  DC,  32, Cur,  11A
Aug/29/00, 12:19:00, AC1,  117,  AC2,  117,  Temp,  69, HUM,  54,  DC,  32, Cur,  11A
Aug/29/00, 12:20:00, AC1,  117,  AC2,  117,  Temp,  69, HUM,  54,  DC,  32, Cur,  11A
Aug/29/00, 12:21:00, AC1,  118,  AC2,  117,  Temp,  69, HUM,  54,  DC,  34, Cur,  11A
Aug/29/00, 12:22:00, AC1,  117,  AC2,  118,  Temp,  68 HUM,  54,  DC,  34, Cur,  11A
Aug/29/00, 12:23:00, AC1,  118,  AC2,  118,  Temp,  68, HUM,  54,  DC,  34, Cur,  11A
Aug/29/00, 12:24:00, AC1,  118,  AC2,  118,  Temp,  65, HUM,  54,  DC,  34, Cur,  10A
Aug/29/00, 12:25:00, AC1,  118,  AC2,  118,  Temp,  65, HUM,  54,  DC,  32, Cur,  10A
Aug/29/00, 12:26:00, AC1,  118,  AC2,  118,  Temp,  65, HUM,  54,  DC,  32, Cur,  10A
Aug/29/00, 12:27:00, AC1,  119,  AC2,  118,  Temp,  65, HUM,  54,  DC,  32, Cur,  9A
Aug/29/00, 12:28:00, AC1,  119,  AC2,  118,  Temp,  65, HUM,  54,  DC,  32, Cur,  9A
Aug/29/00, 12:29:00, AC1,  119,  AC2,  119,  Temp,  66, HUM,  54,  DC,  32, Cur,  9A
Aug/29/00, 12:30:00, AC1,  119,  AC2,  119,  Temp,  66, HUM,  54,  DC,  30, Cur,  9A
Aug/29/00, 12:31:00, AC1,  119,  AC2,  119,  Temp,  66, HUM,  54,  DC,  30, Cur,  10A
Aug/29/00, 12:32:00, AC1,  119,  AC2,  118,  Temp,  66, HUM,  54,  DC,  30, Cur,  11A
Aug/29/00, 12:33:00, AC1,  119,  AC2,  118,  Temp,  67, HUM,  53,  DC,  31, Cur,  11A
Aug/29/00, 12:34:00, AC1,  119,  AC2,  118,  Temp,  67, HUM,  53,  DC,  31, Cur,  12A
Aug/29/00, 12:35:00, AC1,  118,  AC2,  118,  Temp,  67, HUM,  53,  DC,  32, Cur,  16A
Aug/29/00, 12:36:00, AC1,  118,  AC2,  118,  Temp,  67, HUM,  52,  DC,  32, Cur,  17A
Aug/29/00, 12:37:00, AC1,  117,  AC2,  118,  Temp,  68, HUM,  52,  DC,  32, Cur,  17A
Aug/29/00, 12:38:00, AC1,  115,  AC2,  117,  Temp,  68, HUM,  52,  DC,  32, Cur,  14A
Aug/29/00, 12:39:00, AC1,  115,  AC2,  117,  Temp,  68, HUM,  52,  DC,  32, Cur,  10A
Aug/29/00, 12:40:00, AC1,  115,  AC2,  117,  Temp,  69, HUM,  52,  DC,  32, Cur,  9A
Aug/29/00, 12:41:00, AC1,  116,  AC2,  117,  Temp,  69, HUM,  54,  DC,  32, Cur,  9A
Aug/29/00, 12:43:00, AC1,  118,  AC2,  118,  Temp,  69, HUM,  54,  DC,  32, Cur,  8A
```

Each line of the transmission has the Time and Date that the data was recorded, and the sample of the average reading summed for one minute.

Typing, or Transmitting the Escape character at any time will terminate the transmission of this report.

Typing the Space bar will Pause or re-start the report.

C5 - Clear all events, and data log:

This Command will clear all of the events, and all of the Data log information stored in the internal Battery backed RAM. The summary report quantities will be reset to zero, and the Data Logging will start tracking voltage again.

Transmit or type: **C5**

The PQR1010 will respond by transmitting the following message

```
Are You Sure you want to CLEAR ALL DATA on this board ?  Y
```

To clear the data, answer this question with a **CAPITAL Y**

The unit will then test and clear all internal RAM.
The following text will be transmitted during the RAM clear operation.

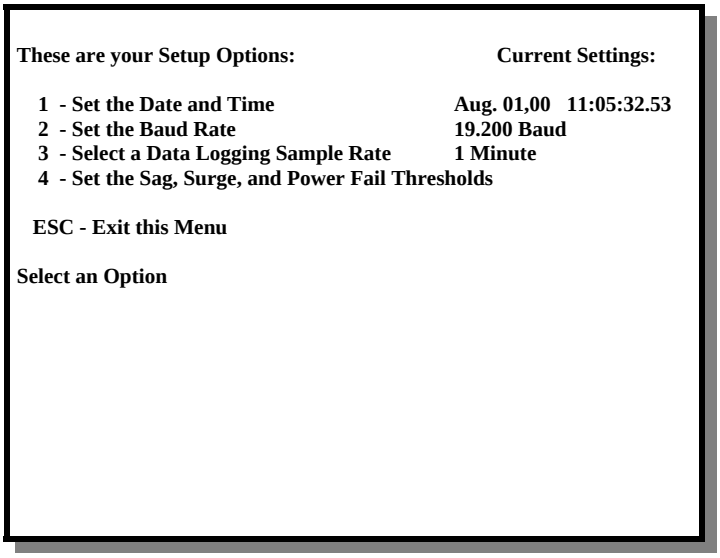
```
Are You Sure you want to CLEAR ALL DATA on this board ?  Y
Testing RAM |————————————————————| -  Ram test Passed
Clearing Ram  ..... Done
```

C6 - Configure the PQR Hardware:

This command will transmit the Setup Command Menu back to the operator through the serial port.

Transmit or type: **C6**

The PQR1010 will respond with:


These are your Setup Options:
Current Settings:
1 - Set the Date and Time
Aug. 01,00 11:05:32.53
2 - Set the Baud Rate
19.200 Baud
3 - Select a Data Logging Sample Rate
1 Minute
4 - Set the Sag, Surge, and Power Fail Thresholds
ESC - Exit this Menu
Select an Option

This Menu can be called up any time the operator is connected to the unit.

The Current Settings show how the OM-PQR1010 is configured at that time.

C6 - (Option 1) Set the Date and Time:

This Command allows the operator to change the Time and Date setting inside the OM-PQR1010.

Select Option 1: **1**

The PQR1010 will respond by transmitting the following message

Input the Date and Time in the format MM/DD/YY,HH:MM:SS

MM =	Month,	Jan = 01, Feb = 02, Mar = 03, Apr = 04, May = 05, Jun = 06, Jul = 07, Aug = 08, Sep = 09, Oct = 10, Nov = 11, Dec = 12
DD =	Day	1st = 01, ... 31st = 31
YY =	Year	2001 = 01
HH =	Hour	1:00 AM = 01, 1:00 PM = 13
MM =	Minute	0 = 00, 59 = 59
SS =	Second	0 = 00, 59 = 59

The data must be entered in the format shown, including commas slashes, and colons. After entering the Time and Date, enter a Carriage Return.

C6 - (Option 2) Set the Baud Rate:

This Command allows the operator to change the communications Baud rate setting inside the PQR1010.

Select Option 2: **2**

The PQR1010 will respond by transmitting the following message

Select a Baud Rate - Currently set to 19,200 Baud

1) 1200	**2) 2400**	**3) 4800**
4) 9600	**5) 14400**	**4) 19200**

Warning - You will need to change the rate on your terminal to match the PQR

Typing the number indicated next to the desired rate will change the rate of the PQR1010 immediately to the new rate

Note:

Changing the baud rate breaks the connection between the PQR1010 and the communications device it is connected to. The rate on the connected device must be changed to match the new rate of the PQR1010.

When the rate is changed, the new setting is saved in Non-Volatile RAM, and is used as the power up default until the next time the setting is changed.

C6 - (Option 3) Set the Data Logger:

This Command allows the operator to change the interval between data logger readings inside the PQR1010.

Select Option 3: **3**

The PQR1010 will respond by transmitting the following message

Enter the number of seconds between Data log samples

1) 1 Sec	**2) 5 Sec**	**3) 10 Sec**
4) 30 Sec	**5) 1 Min**	**4) 4 Min**

Any other choice sets the rate to 1 Minute.

New Rate:

Typing the number indicated next to the desired rate will change the rate of the PQR1010 immediately to the new rate

Note:

When the rate is changed, the new setting is saved in Non-Volatile RAM, and is used as the power up default until the next time the setting is changed.

C6 - (Option 4) Set the Surge, Sag, and Power Fail:

This Command allows the operator to change the threshold points for the PQR1010 events.

Select Option 4: **4**

The PQR1010 will respond by transmitting the following message

```
AC channel - Surge Threshold ..... :   (5%, 10%) .. :
AC channel - Sag Threshold ..... :   (5%, 10%) .. :
AC channel - Power Failure ..... :   (5%, 10%) .. :

DC Channel - Surge Threshold ..... :   (5%, 10%) .. :
DC Channel  - Sag Threshold ..... :   (5%, 10%) .. :
DC Channel - Power Failure ..... :   (5%, 10%) .. :

Temp channel - Surge Threshold ..... :   (5%, 10%) .. :
Temp channel - Sag Threshold ..... :   (5%, 10%) .. :
```

To set a fixed threshold, type the desired number of the setting:

To set the Temperature Surge setting to 98 degrees, type 98 at
Temp channel - Surge Threshold .... : (5%,10%) .. : ***98***
followed by a carriage return.
The PQR1010 will calculate the nearest trip point, and respond **(96d)**, indicating that it will now trip at 96 degrees.

To set the Temperature Surge setting to trip at 5% and 10%, type 0 at
T**emp channel - Surge Threshold .... : (5%,10%) .. :** ***0***
followed by a carriage return.
The PQR1010 will respond ***(5%,10%)***, indicating that it will now trip at 5% and 10% above the average value.

Note:
These settings are saved in Non-Volatile RAM, and are used as the power up default.

C90 - Continuous Transmission of channels voltage:

This Command allows the operator to view the readings present on each of the AC, DC Aux, and Current channels.

Transmit or type: **C90**

The PQR1010 will respond by transmitting the following:

```
Unit Off-Line  -  entering Calibration mode

Ph1: 120V   Ph2: 117V   Aux: 68    DC1 +6.3V    DC2: 413V  Cur:  11A
Unit returning to On-Line mode
```

The unit will send this reading continuously, resulting in the screen being updated about three times a second.

This command is helpful in confirming the unit is properly connected to the signals under test. If there is no signal attached to the test input, the reading will be zero.

To quit the test, send any character to the unit, or wait for 30 seconds when the unit will return to the on-line testing mode on it's own.

CX - Hang up the phone:

This Command allows the operator to disconnect the signal from a phone line on a Modem attached to the PQR1010.

Transmit or type: **CX**

The PQR1010 will respond by transmitting the following:

Thank you, and good bye.
+++ ATH0

Having sent this message, the unit then sends the hang-up command to the modem. If there is a modem connected, and it had the phone off-hook, it would put the phone on-hook.

AC Channels Specifications

RMS Voltage (Data Logging):
- Range: 80 - 480 Vac RMS
- Accuracy: +/- 1.5%
- Sample rate: Programmable - range 1 reading per second to 1 reading per 4 minutes

Sags/Surges:
- Threshold: 5% and 10% of average RMS
- Duration limits: 1 cycle or 20 milliseconds
- Accuracy: +/- 1.5%

Dropouts:
- Threshold: Less than 10V rms
- Duration limits: Longer than 8 ms, Shorter than 80ms

Power Failure:
- Threshold: Less than 10V rms
- Duration limits: Longer than 80ms

Impulses:
- 2 Channels: 20V to > 2500 Vpeak
- Resolution: thresholds 5 volt steps
- Accuracy: +/- 10%
- Pulse detection: 500 nano seconds above threshold

High Frequency Noise:
- Range: 2 volts peak, 10 Khz - 10 Mhz
- Accuracy: +/- 10%
- Response time: 1 milli second

Line Frequency:
- Range: 40 - 400 Hz
- Accuracy: +/- 1%
- Response time: 1 AC cycle
- Threshold: +/- 2% deviation from average

DC Channel Specifications

RMS Voltage (Data Logging):

- Ch #1 Range: +/-1 to +/-52 Vdc
- Accuracy: +/- 1.5%
- Sample rate: Programmable - range 1 reading per second to 1 reading per 4 minutes

Sags/Surges:

- Threshold: 5% and 10% of average
- Duration limits: 20 milliseconds
- Accuracy: +/- 1.5%

Dropouts:

- Threshold: Less than 10% of average
- Duration limits: Longer than 8 ms, Shorter than 80ms

Power Failure:

- Threshold: Less than 10% of average
- Duration limits: Longer than 80ms

Impulses:

- 2 Channels: 20V to > 2500 Vpeak
- Resolution: thresholds 5V steps
- Accuracy: +/- 10%
- Pulse detection: 500 nano seconds above threshold

High Frequency Noise:

- Range: 2 volts peak, 10 Khz - 10 Mhz
- Accuracy: +/- 10%
- Response time: 1 milli second

Current Channel

RMS Current (Data Logging):

- Range: 0.2 amps to 1000 amps rms
- Accuracy: +/- 1.5%
- Sample rate: Programmable - range 1 reading per second to 1 reading per 4 minutes

Sags/Surges:

- Threshold: 5% and 10% of average
- Duration limits: 20 milliseconds
- Accuracy: +/- 1.5%

Dropouts:

- Threshold: Less than 10% of average
- Duration limits: Longer than 8 ms, Shorter than 80ms

Power Failure:

- Threshold: Less than 10% of average
- Duration limits: Longer than 80ms

Temperature Channel

Temperature: (Data Logging):

- Range: 20 to 250 degrees (0.02 - 2.5 vdc)
- Accuracy: +/- 1%
- Sample rate: Programmable - range 1 reading per second to 1 reading per 4 minutes

Sags/Surges:

- Threshold: 5% and 10% of average
- Duration limits: 2 seconds
- Accuracy: +/- 1.5%

Humidity Channel

Humidity: (Data Logging):

- Range: 20 to 250 degrees (0.02 - 2.5 vdc)
- Accuracy: +/- 1%
- Sample rate: Programmable - range 1 reading per second to 1 reading per 4 minutes

Sags/Surges:

- Threshold: 5% and 10% of average
- Duration limits: 2 seconds
- Accuracy: +/- 1.5%

Mechanical Specifications

- Weight: 4 pounds
- Size: 8” wide x 10” deep, x 2” high
- Power Cord: 6 feet

Operating Specifications

- Temperature: 0 - 50 degrees C
- Humidity: 10% to 80% (non condensing)
- AC Voltage : 80 - 260 volts ac
- DC Voltage: 12 - 30 volts dc
- Current : 0.1 amp
- Line Frequency: DC - 400 Hz

Serial Interface Specifications

- Connector: DB9 - RS 232C
- Baud Rate: Programmable - 1200 to 19,200 baud
- Protocol 8 Data, 1 Stop, No Parity bits

Data Storage Specifications

- Summary Event Count: 56,000 of each event type
- Detail Storage: 56,000 events total
- Data Retention: 99 Years without power

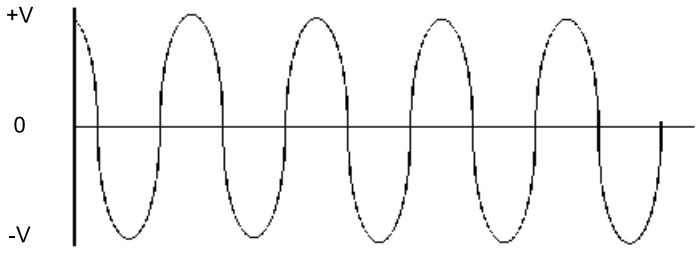
Types of Power Problems
and what they look like.

There are many types of power problems that can affect the quality of the AC power being delivered to a piece of equipment. Different types of problems will have different effects on the operation, or even life expectancy of this equipment. Knowing what these problems are, and what some of the consequences are of having these problems, can help in the process of identifying what can be done to help protect this equipment.

The following pages describe several of the more common types of Power disturbances, and list what some of the causes are.

- Dropout - Power Failure
- Sag
- Impulse
- Common Mode Noise
- Surge
- High Frequency Noise

Figure PT 1 Typical AC Waveform



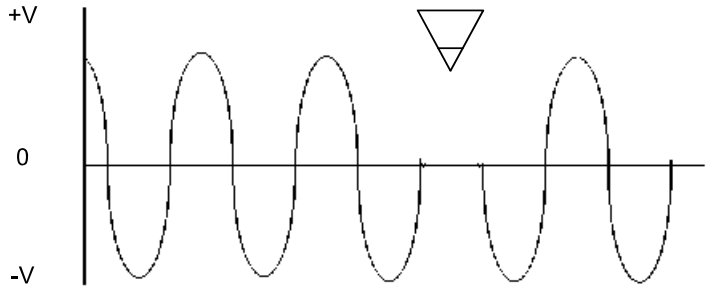
DROPOUT (NOTCH)

A condition where a portion of the sine wave has a lower than expected value or is missing entirely, usually for a portion of a cycle. These types of problems can be caused when large motors are started, Lightning arresters are employed (during a lightning hit), or when electrical equipment fails. Dropouts can lead to failures in computers and electronic equipment , reduced life of motors and flickering lights.

POWER FAILURE

When the duration of a dropout exceeds 1 cycle it is usually referred to as a Power Failure, or Blackout. This problem is the easiest to observe.

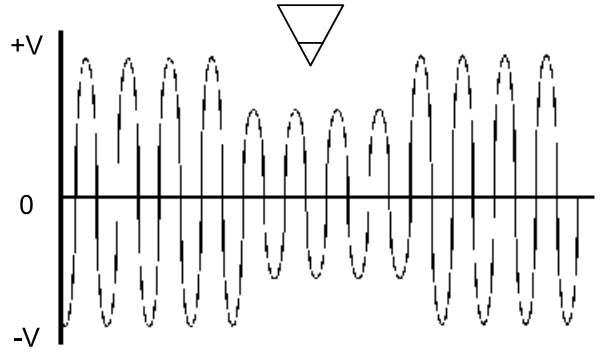
Figure PT 2 - Dropout



SAG
(UNDER-VOLTAGE, DIP, or BROWNOUT)

A power sag (or low line voltage) is a decrease in line voltage of at least 10% of the average line voltage for half a cycle or longer. The power sag is often caused by large inductive equipment (e.g. photocopy, postage equipment) being applied on the same AC line as is being tested. Sags can be caused by external factors as well, such as large power draining equipment used in other buildings. Sags can be particularly detrimental to electronic equipment because of the malfunctions caused by the sudden decrease of available voltage to the power supply. Complete failure rarely occurs, and often the equipment user continues to operate the device, unaware of the potential logic circuit problems that may have occurred.

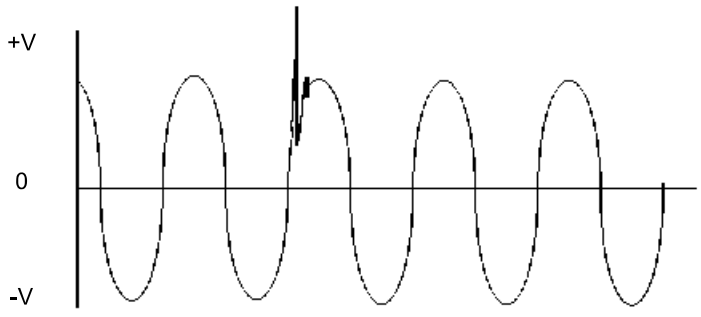
Figure PT 3 - Sag



IMPULSE
(SPIKE, SURGE)

The spike is a surge of energy superimposed on the AC line, usually with a relatively short duration. Spikes can potentially have the most serious effects on electronic equipment due to their high energy content, and the Integrated Circuits inability to absorb the energy. Many events can cause spikes, such as lightning bolts, utility grid switching, switching inductive loads on and off, and SCR (Silicon Control Rectifier) dimmers. Although properly designed equipment has some built-in spike protection, repeated hits by high energy spikes can eventually render these components useless.

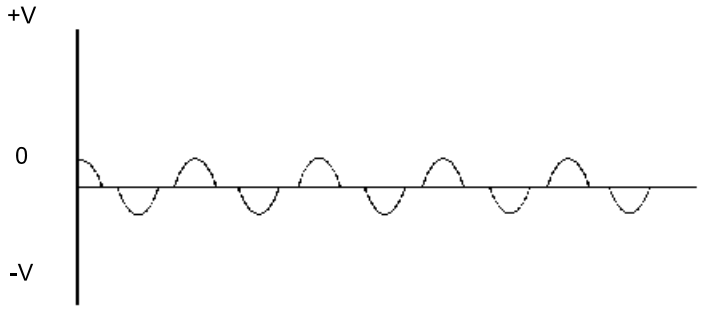
Figure PT 4 - Impulse



COMMON MODE NOISE

In single phase power systems, as found in many countries such as the USA, the load (computer or equipment) is connected between the hot and neutral line. Usually the neutral line is connected to earth ground at the service entrance, so that in effect the neutral line should have 0 volts at the load. At a typical site, voltage is induced onto the neutral line by other equipment. This voltage can appear in the form of impulses, or a continuous pseudo sine wave.

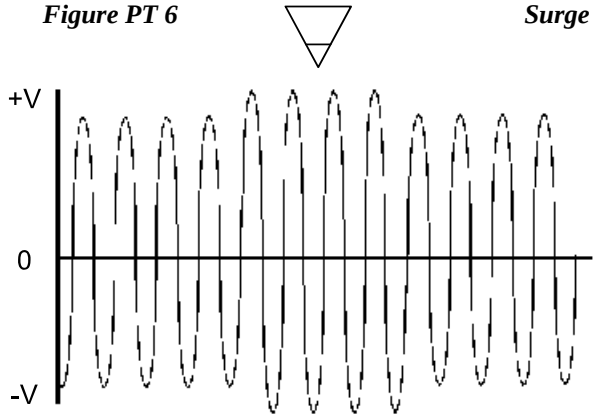
Figure PT 5 - Common Mode Noise



SURGE
(SWELL OR OVER-VOLTAGE)

A power surge is the opposite of a sag and is often referred to as "High Line Voltage". A surge is defined as an increase in line voltage above 128 volts (on a 115V Line) for a half cycle or longer. Like the sag, the power surge is often caused by large inductive loads being applied on the same line. Power surges cause some of the most dangerous occurrences, and their results are the most difficult to correct.

Figure PT 6 ***Surge***



HIGH FREQUENCY NOISE

High frequency noise can be caused by electronic equipment feeding internal noise back onto the power line, or logic induced noise from switching power supplies. This noise is transferred to the AC line causing disturbances greater than 2V peak-to-peak superimposed on the AC sine wave (normal mode noise). This noise can cause internal component degradation and eventual system failure. During this degradation period, system lockups, resets and data transfer will increase.

Figure PT 7 - High Frequency Noise